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54 DEVICE FOR TRANSFERRING CONTAINERS CONSISTING OF A GUIDE WHEEL HAVING A VARIABLE GEOMETRY

57 The invention involves a device for transferring containers of the type in which the containers (12) are transferred in a path in a circular arc around a central axis (A1) of the transfer device (10), of the type in which the device consists of at least one support wheel (20) and one guide wheel (24) which are moved in the same rotational movement around the axis (A1) of the device, and of the type in which the guide wheel (24) has, on its periphery, cavities whose dimensions are adapted to the dimension of the containers (12) to be transferred,

characterized in that the guide wheel (24) consists of mechanisms to make the dimension of the cavities vary so that they can be adapted to the dimensions of the containers (12) to be transferred.

[bar code]

Device for transferring containers consisting of a guide wheel having a variable geometry

The invention involves the field of transfer devices that are notably used in production lines, treatment lines, filling lines, and processing lines for containers. More particularly, it involves transfer devices in which the containers are handled individually with a predetermined spacing or step.

The invention will find application notably in bottling lines such as lines for bottling plastic bottles.

More specifically, the invention will be described in an application for transferring bottles made of polyethylene terephthalate (PET) that are able to be transported by the neck.

Often, on the same processing line, it is desirable to be able to use several types of containers, where these containers vary notably in their size.

In the case of bottles made of PET, the handling of the bottles by the neck is preferred since bottles with different sizes can be designed having approximately the same neck in a manner so that, from the point of view of the support of the bottles, there is no modification to be made on the line when the size of the bottles is changed. This arrangement makes it possible, in particular, to not have to make any adjustment of the height.

However, in the transfer of containers, it is also necessary to provide guide mechanisms that make it possible to ensure good maintenance of the position of the containers all along their transport.

Thus, it is known to transfer the bottles made of PET on wheels for transfer moved by a continuous rotational movement (or possibly sequential) around their axis. On a transfer device of this type, the bottles thus follow a path in a circular arc between their loading points and unloading points on the wheel. All along this transfer, the bottles are subject to various acceleration and deceleration forces, both tangential and radial.

When the bottles are suspended by their neck, it runs the risk of being destabilized by these forces, and thus the necessity for providing mechanisms for guiding the bodies of the bottles.

Also, in the transfer devices known until today, the transfer wheels consist of, in addition to the notched wheel that supports the containers, a guide wheel. This guide wheel is generally made in the form of a plate, possibly made of plastic material, whose outside circular contour has, at regular intervals corresponding to the step that separates the containers, cavities that are made hollowed out radially towards the inside in order to support the containers. Of course, in order to prevent any jolting of the containers, the shape and the dimension of the cavities must be fitted to the shape of the body of the containers. But as it often happens, if the necks of the containers are standardized, the same may not be the case for their bodies, of course.

Also, a change of the size of the bottles generally makes it necessary to change the guide plates of each of the transfer wheels of the line. Such an operation makes it necessary to provide a set of as many plates as there are different sizes of bottles and,

especially, it increases the downtime of the line when changing the size, which is very penalizing in terms of costs.

This problem does not present itself only in the case of the transfer of bottles suspended by their neck. It is found in a general manner in the transfer of all types of containers, including when they are supported by their bottom.

The invention thus has the purpose of proposing a new design of the guide mechanisms in the devices for transfer of containers, where these new mechanisms must be able to be adapted very quickly to the different sizes of the containers able to be transferred by the device.

For this purpose, the invention proposes a device for the transfer of containers, of the type in which the containers are transferred over a path in a circular arc around a central axis of the transfer device, of the type in which the device consists of at least one support wheel and a guide wheel which are moved in the same rotational movement around the axis of the device, and of the type in which the guide wheel has, on its periphery, cavities that are arranged radially hollowed out relative to an outside envelope circle of the guide wheel, and whose dimensions are adapted to the dimension of the containers to be transferred, characterized in that the guide wheel consists of mechanisms to make the dimension of the cavities vary so that they can be adapted to the dimensions of the containers to be transferred.

According to other characteristics of the invention:

- the guide wheel consists of two concentric superposed plates, each plate being equipped with a series of teeth projecting radially to the outside, each tooth consisting of a left edge and a right edge, in that each cavity of the guide wheel is delimited in width by the left edge of a tooth of a first of the two plates and by the right edge of a tooth of the second of the two plates, and, in making the relative angular position vary around their axis, the width of all of the cavities of the guide wheel is simultaneously made to vary;
- each of the teeth of the two plates consists of two tension adjusters, one of which is arranged at the head of the tooth, the other at the foot of the tooth, and which are arranged along the edge of the tooth that functions to delimit the cavity, and the guide wheel consists of a belt that is held on the tension adjusters in a manner so as to approximately follow the envelope circle between two cavities;
- the belt can be extended in order to adapt to the variation of the length of the distance delimited by the tension adjusters when the two plates are displaced relative to each other in order to make the width of the cavities vary;
- the containers are supported on the belt;
- during an operation for changing the width of the cavities, the two plates are each shifted angularly by a same angular value in the two opposite directions in such a manner that the global position of the cavities on the guide wheel does not vary;
- each plate is provided with an aperture that extends in a circular arc around the axis of the device, the apertures of the two plates being provided in order to be arranged axially one relative to the other, the aperture of one of the two plates is provided with a rack on its radial inside edge while the aperture of the other plate is provided with a rack on its radial outside edge, and the device consists of a control pinion that is engaged axially in the apertures in a manner so as to simultaneously act together on one side with the rack constructed on the inside radial edge, and on the other side with the rack

constructed on the outside radial edge, by which a rotation of the pinion around its axis causes an angular displacement of each of the two plates by a same angular value but in opposite directions around the axis of the device;

- the support wheel is a wheel that is fitted to grab the containers at the level of their open end, and the guide wheel acts together with the body of the containers; and
- the device consists of a second guide wheel that is provided in order to act together with the bottom of the containers, and the second wheel is adjustable in height and consists of a funnel-shaped contact surface against which the bottom of the containers comes to be supported radially to the outside.

Other characteristics and advantages of the invention appear in reading the detailed description that follows as well as in the attached drawings, in which:

- Figure 1 is a schematic sectional axial view of a transfer device according to the instructions of the invention, the device being configured for the transfer of a first bottle size;
- Figure 2 is a view similar to that of Figure 1, the device being configured in order to transfer a second bottle size;
- Figures 3 and 4 are plan views, from above, of each of the two plates of the guide wheel;
- Figures 5 and 6 are views from above of the two superposed plates, shown in two different relative angular positions;
- Figures 7, 8 and 9 are schematic perspective views showing the assembly of the guide wheel according to the invention;
- Figures 10 and 11 are partial views, from above, showing two possible configurations of the guide wheel; and
- Figure 12 is a partial enlarged view of Figure 1 showing more specifically the attachment mechanisms of the guide wheel on the support wheel.

A general schematic view of the transfer device 10 according to the instructions of the invention is shown in Figures 1 and 2. In this case, this involves a transfer wheel that is fitted to transport the bottles 12 by their neck 14. The bottles 12 are, for example, bottles made of polyethylene terephthalate (PET) whose necks 14 consists of an outside radial flange by which they can be supported, both when they are empty and when they are full.

The transfer wheel 10 consists, mounted on a fixed table 16, of a carousel rotating around a vertical axis A1. The carrousel consists of a main shaft 18 that is guided in rotation around its axis A1 in a shaft 84 and whose lower end passes below the table 16 and consists of a driving pulley 19 around which a belt (not shown) driven by a motor is designed to be wound. The main shaft 18 is thus driven in rotation in a continuous manner around its axis A1. At its upper end, the shaft 18 consists of a support wheel 20 that is made, for example, in the form of a circular disc having the axis A1, equipped at its periphery with semi-circular notches spaced angularly in a regular manner. The transfer wheel also consists of an external fixed guide 22 that extends in a circular arc around the support wheel 22 on an arc comprised between the loading and unloading points of the bottles on the wheel 20. Thus, it is planned that, at the level of the loading point, the bottles 12 are guided along a path tangential to the wheel in a manner to be engaged by their neck in a notch of the support wheel in order to be driven in rotation by

the support wheel 20. Each bottle handled this way then becomes engaged radially by its neck between the support wheel 20 and the outside guide 22. The bottle is then supported by its radial outside flange both on the support wheel 20 that drives it and on the fixed guide 22 on which it slides. In all cases, the bottle is supported perfectly by its neck and can not come out of its notch.

However, if the bottle was not additionally held, it could swing relative to its support point. Also, the transfer wheel 10 consists of two complementary guide instruments: a guide wheel 24 that acts together with the body of the bottle, and which blocks by itself any tangential movement of the bottle, and a lower guide crown wheel 26 that, in combination with the guide wheel 24, blocks any radial jolting of the bottles.

According to a first aspect of the invention, the guide wheel 24 is planned to be able to adapt to the different sizes of the bottles 12, whereby these sizes differ in particular by the diameter of the bottle body.

In fact, the guide wheel 24 appears in a global manner in the form of a disc having an axis A1 that is unified in rotation with the support wheel 20 and which is equipped, on its periphery, with cavities 28 provided in order to receive and immobilize the body of a bottle. Of course, the cavities 28 are arranged in connection with the notches of the support wheel 20.

According to the invention, the guide wheel 24 is mainly formed from two annular plates 30, 32 having the axis A1 that are superposed and which, as can be seen in Figures 3 and 4, are provided with teeth 34, 36 projecting radially to the outside. According to the invention, when the two plates 30, 32 are superposed, they delimit, between their teeth 34, 36, the cavities 28. Thus, as seen from above, each cavity is delimited in width on one side by the left edge 38 of a tooth of a first 30 of the two plates, and, on the other side, by the right edge 40 of a tooth 36 of the second 32 of the two plates. Thus, for the purpose of simplicity, the plate 30 whose teeth 34 delimit the cavities by their left edge 38 is hereinafter referred to as "left plate", and the plate 32 whose teeth 36 delimit the cavities 28 by their right edge 40 is hereinafter referred to as "right plate". The notions of right and left involving the edges of the teeth 34, 36 must be understood as seen from the axis A1.

In the example shown, the teeth 34, 36 of the two plates are not symmetrical. In fact, it can be seen that their active edge 38, 40 is curved, in a manner so as to allow more of the material to remain at the foot of the tooth, while their other edge is approximately straight and oriented along a radius coming from the axis A1. The two plates 30, 32 are thus not identical.

As can be seen in Figures 5 and 6, the width of the cavities 28, along the tangential direction, varies as a function of the relative angular position of the two plates 30, 32. In the configuration of Figure 6, the cavities have a low width while in that of Figure 5, the cavities 28 have approximately their maximum width. The device that makes it possible to regulate the relative angular position of the two plates 30, 32, will be described later.

Thus, with a guide wheel having two plates, the width of the cavities 38 can be fitted easily to the dimension of the containers to be transferred in order to ensure a perfect guiding.

However, such a guide wheel can, in certain conditions, not be fully satisfactory. In fact, it is observed that the width of the teeth 34, 36, at the level of their head, is limited so that the plates can be used with the bottles having a body with a large width. And yet when these same plates 30, 32 are used with small bottles, it can be seen in Figure 6 that the teeth allow relatively large "false cavities" 42 to remain between the cavities 28. And yet, at the level of the loading of the containers on the transfer wheel 10, it can happen that the containers come in at a considerable incline. Such a risk exists notably when the transport of the bottles up to the transfer wheel involved is carried out by an air conveyor. In this case, it is possible that a container is grabbed by its neck in a notch of the support wheel but that, due to its incline, its body does not come to be grabbed in the corresponding cavity 28 of the guide wheel 24, but in a "false cavity" 42 on the other side of one of the teeth 34, 36. Of course, such a case will lead almost definitely to a jamming and stopping of the system.

According to another aspect of the invention, mechanisms that make it possible to prevent a container coming to be grabbed in a "false cavity" 42 are thus provided.

For this purpose, it can be seen that each of the teeth 34, 36 consists of two belt tensioning rollers 44 that are arranged respectively at the two ends of its active edge 38, 40, the one at the head of the tooth and the other at the foot of the tooth. In this manner, when the two plates 30, 32 are superposed, each cavity is delimited by four tension adjusters 44.

As can be seen in Figures 7 to 9, the tension adjusters are made in the form of cylindrical shafts having axes parallel to the axis of the plates. In the example shown, the tension adjusters 44 are oriented vertically towards the top, and, preferably, the tension adjusters 44 that are carried by the lower plate are longer than those carried by the upper plate so that the tension adjusters reach approximately the same level.

In fact, these tension adjusters are provided in order to make it possible to wind a belt 46 that is designed to make the guide wheel turn. The belt 46 is wound up radially to the outside on the tension adjusters located at the head of the tooth and towards the inside on the tension adjusters located at the foot of the tooth. In this way, between each cavity, the belt 46 follows approximately the envelope circle of the teeth 34, 36 (in fact, between two teeth, this involves a straight head segment 47 joining the two tension adjusters of the head of the teeth), and, at the level of each cavity, the belt 46 approximately follows the profile of the cavity. In reality, at the level of each cavity, the belt forms a pseudo-cavity with two side segments 48 that approximately correspond to the two lateral edges 38, 40 of the cavity 28 and with, between the two lateral segments, a bottom segment 50 that is approximately tangent to the circle of the foot of the teeth 34, 36.

When the plates are displaced angularly relative to each other, as shown between Figures 10 and 11, the two teeth 34, 36 that delimit a cavity 28 have a tendency to separate from each other, which tends to lengthen the size of the segment of the bottom 50 of the pseudo-cavity delimited by the belt 46. But, at the same time, each of these two teeth gets respectively closer to the teeth that delimit the adjacent cavities. This causes the length of the segment of the head 47 of the belt to become reduced. As a function of the specific geometry or positioning of the tension adjusters, it happens that the total length of the path of the belt 46 varies a little if the reduction of the head segments 47 do not exactly make up for the increase of the foot segments 50 of the belt. Also, it is

preferable to use a belt that has a specific capacity for elongation, for example, a belt made of polyurethane.

Preferably, as can be seen in Figures 10 and 11, the exact position of the diameter of the tension adjusters of the head will be chosen so that the lateral segments of the belt 46 extend partly "into the void", outside of the imprint of the teeth. In this way, as soon as they come into direct contact with the plates 30, 32, the containers come to rest on the belt 46, which limits the risks of damage to the containers.

Preferably, the tension adjusters of the feet of the teeth are arranged so that the side segments 48 of a same notch are not parallel between them but have an arrangement in a V-shape open radially to the outside. Thus, in the two examples shown which involve containers cylindrical in rotation, it is seen that the regulation of the plates is selected in such a way that the bottle only comes to be supported by two points on the guide wheel: on the side segments 48 of the belt 46.

To control the rotation of the two plates 30, 32, a device is provided which makes it possible to turn the two plates simultaneously at a same angular value but in the opposite directions around the axis A1. Thus, during the dimensional adaptation of the cavities 28, they stay globally fixed relative to the notches of the support wheel 20.

As can be seen in Figures 1 and 12, the guide wheel is suspended below the support wheel 20 by the intermediary of three columns that are fixed at their upper end on the support wheel 20. In the example shown, two suspension columns 52 and one control column 66 can be distinguished.

At their lower end, the columns 52, 66 have a section 54 of narrowed diameter that is provided in order to extend axially through the corresponding apertures 56, 58, 68, 70 arranged in the two plates 30, 32. The apertures 56, 58, 68, 70 are arranged in a circular arc around the axis A1 and thus have approximately a bean shape.

For the suspension columns 52, the diameter of the sections 54 approximately corresponds to the width of the corresponding apertures 56, 58. Two washers 60 are mounted on the section 54, on both sides of the two plates 30, 32 and a screw 62 is screwed into the lower end of the section 54 so as to hold the lower washer 60 axially towards the bottom. Of course, the washers 60 have a diameter greater than the width of the apertures 56, 58. Thus, the stack that is formed by the lower washer, the plates 30, 32, and the upper washer is axially clasped between the screw 62 and a shoulder 64 that delimits the section 54 to the top. However, a slight amount of axial play is provided that allows the plates to turn around the axis A1.

As for the third control column 66 that is shown more specifically in Figures 7 to 9, it can be observed that its end section is a prismatic section in order to be able to guide a pinion 72 in rotation, whose height corresponds approximately to the combined thickness of the two plates. The pinion 72 is designed to be received inside the apertures 68, 70 of the two plates 30, 32. As can be seen in Figure 7, the aperture 68 of the plate 30 consists of an outside radial edge equipped with teeth in order to form a first rack 74. As far as the aperture 70 of the plate 32 is concerned, its radial inside edge forms a second rack 76.

The pinion 72, when it is received inside the apertures as shown in Figures 8 and 9, thus acts together from one side with the first rack 74 in order to guide one of the plates along a first rotational direction, and, simultaneously, from the other side with the second

rack 76 in order to guide the other plate 32 along the opposite direction.

By this device, it is planned to be able to drive the control column 66 in rotation around its axis A2, either manually using a key, or by the intermediary of a motor, and this in order to cause the rotation of the pinion 72 around its axis. The column being fixed by its upper end on the support wheel with only one possibility for rotation around its axis A2, the pinion stays globally fixed relative to the support wheel. Also, when the pinion 72 is made to rotate at a specified angle around its axis A2, it drives the two plates 30, 32 in rotation around their axis A1, by the intermediary of the two racks 74, 76. In this case, the turning angle of the plates is identical, but this turning is done in opposite directions around the axis A1.

By this design of the drive device, the two plates move away at a same angle, the cavities become enlarged or contracted without their median plane being moved, in such a way that it stays directly below the notches of the support wheel without it being necessary to take special precautions for alignment during these changes to the size.

The control column 52 also has a function of suspending the plates since the pinion 72 is clasped between two washers 60 that have a diameter greater than the width of the apertures 68, 70 and that are blocked axially between an upper shoulder of the column 66 and a screw 62.

The three columns 52, 66 being arranged approximately at 120 degrees from each other around the axis A1, the guide wheel 24 is held perfectly relative to the support wheel, the plates can not move other than in rotation around the axis A1. Of course, this possibility for rotation around the axis A1 is blocked as soon as the pinion 72 is itself fixed in rotation around its axis A2.

Thus, due to the guide wheel 24 according to the invention, the containers are held perfectly radially to the inside and tangentially relative to the axis A1.

However, in the transfer device which is described here, it is not planned that the guide wheel 24 grabs the containers, even though this would be possible, if necessary, by providing an appropriate design of the cavities 28. Also, in the example shown, a lower crown guide wheel 26 is provided to act together with the bottom of the containers in order to stop them from moving away radially to the outside. For this purpose, the lower wheel 26 consists of a crown wheel 78 that has a conical contact surface 80, flared to the top in the manner of a funnel. Of course, the crown wheel 78 does not extend over a full circle but only over an arc of a circle that corresponds to the arc of the circle on which the upper guide 22 extends and which corresponds to the path of the containers on the device.

The guide wheel 26 is able to be adjusted in its height so that the contact surface 80 comes to support the bottom of the containers. Thus, due to the conicity of the contact surface 80, the crown wheel 78 is modified, by the simple play of the regulation of the height, for all of the diameters of the bottles and for all of the shapes of the bottom of the bottles.

The regulation of the height of the lower wheel 26 is done in a very simple manner. In fact, the wheel 26 is mounted by a central hub 82 on the axial shaft 84 inside of which the main shaft 18 is guided. The shaft 84 is fixed and united with the frame of the machine. Its outside surface consists of a threading 86 onto which the hub 82 is screwed. The hub 82 consists, in addition, of a pulley 88 on which a belt (not shown) is designed to be wound in order to ensure its rotational drive. Thus, in controlling the

rotation of the hub, a vertical displacement of the assembly of the lower wheel 26 is caused along the threading 86.

The hub 82 is free in rotation relative to the crown wheel 78 in a manner so that the regulation of the height of the lower wheel 26 does not have an effect on the angular position of the crown wheel 78. It is noted that the crown wheel 78 is fixed when the transfer device is functioning. Also, it is preferable that the contact surface 80 is made of a material having a low coefficient of friction so as not to scratch the bottom of the containers that will be caused to rub on this surface during their transfer on the device 10.

The drive belt can be driven directly by an electric motor that is specially dedicated to controlling the height of the lower wheel 26 of the device. However, in one system that consists of several transfer devices similar to the one that has been described, only one and the same motor can be provided to ensure the regulation of the height of all of the lower guide wheels. The different hubs will then be driven either by a set of a series of belts, or by a single belt whose path winds around the several hubs.

The transfer device according to the invention is thus particularly advantageous by the ease of the regulation of guide mechanisms of the containers, this regulation making it possible to ensure a large transfer reliability with a minimum number of malfunctions.

CLAIMS

1. Device for the transfer of containers, of the type in which the containers (12) are transferred over a path in a circular arc around a central axis (A1) of the transfer device (10), of the type in which the device consists of at least one support wheel (20) and a guide wheel (24) which are moved in the same rotational movement around the axis (A1) of the device, and of the type in which the guide wheel (24) has, on its periphery, cavities (28) that are arranged radially hollowed out relative to an outside envelope circle of the guide wheel (24), and whose dimensions are adapted to the dimension of the containers (12) to be transferred,

characterized in that the guide wheel (24) consists of mechanisms to make the dimension of the cavities (28) vary so that they can be adapted to the dimensions of the containers (12) to be transferred.

2. Device for transfer according to claim 1, characterized in that the guide wheel (24) consists of two concentric superposed plates (30, 32), each plate being equipped with a series of teeth (34, 36) projecting radially to the outside, each tooth (34, 36) consisting of a left edge and a right edge, in that each cavity (28) of the guide wheel (24) is delimited in width by the left edge (28) of a tooth (34) of a first (30) of the two plates and by the right edge (40) of a tooth (36) of the second (32) of the two plates, and, in making the relative angular position of the two plates (30, 32) vary around their axis (A1), the width of all of the cavities (28) of the guide wheel (24) is simultaneously made to vary.

3. Device for transfer according to claim 1, characterized in that each of the teeth (34, 36) of the two plates (30, 32) consists of two tension adjusters (44), one of which is arranged at the head of the tooth, the other at the foot of the tooth, and which are arranged along the edge (38, 40) of the tooth that functions to delimit the cavity (28), and in that the guide wheel (24) consists of a belt (46) that is held on the tension adjusters (44) in a manner so as to approximately follow the envelope circle between two cavities (28).

4. Device for transfer according to claim 3, characterized in that the belt (46) can be extended in order to adapt to the variation of the length of the distance delimited by the tension adjusters (44) when the two plates (30, 32) are displaced relative to each other in order to make the width of the cavities (28) vary.

5. Device for transfer according to one of the claims 3 or 4, characterized in that the containers (12) are supported on the belt (46).

6. Device for transfer according to one of the claims 3 to 5, characterized in that during an operation for changing the width of the cavities (28), the two plates (30, 32) are each shifted angularly by a same angular value in the two opposite directions in such a manner that the global position of the cavities (28) on the guide wheel (24) does not vary.

7. Device for transfer according to claim 6, characterized in that each plate (30, 32) is provided with an aperture (68, 70) that extends in a circular arc around the axis

(A1) of the device, the apertures (38, 70) of the two plates being provided in order to be arranged axially one relative to the other, the aperture (70) of one of the two plates is provided with a rack (76) on its radial inside edge while the aperture (68) of the other plate is provided with a rack (74) on its radial outside edge, and the device consists of a control pinion (72) that is engaged axially in the apertures (68, 70) in a manner so as to simultaneously act together on one side with the rack (76) constructed on the inside radial edge, and on the other side with the rack (74) constructed on the outside radial edge, by which a rotation of the pinion (72) around its axis (A2) causes an angular displacement of each of the two plates (30, 32) by a same angular value but in opposite directions around the axis (A1) of the device (10).

8. Device for transfer according to any one of the preceding claims, characterized in that the support wheel (20) is a wheel that is fitted to grab the containers (12) at the level of their open end (14), and the guide wheel (24) acts together with the body of the containers.

9. Device for transfer according to claim 8, characterized in that the device consists of a second guide wheel (26) that is provided in order to act together with the bottom of the containers (12), and in that the second wheel (26) is adjustable in height and consists of a funnel-shaped contact surface against which the bottom of the containers (12) comes to be supported radially to the outside.

[Drawings pages follow]